All-Purpose Remote Transport System
(ARTS)

Capabilities Demonstration

24-26 September 2001

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DISCLAIMER

The technology in this report was evaluated under the Department of Defense Humanitarian Demining Research and Development Program. The information contained in this document is strictly based on the capabilities demonstration and not a technical evaluation of this technology. The purpose of this report is to provide an overview of the capabilities of this system to organizations involved in humanitarian demining activities. DoD does not endorse this technology or company and makes no warranties or representations concerning the use of this product. Interested agencies are encouraged to contact the contractor directly for equipment availability and current pricing. The Department of Defense points of contact, however, would appreciate any and all feedback on equipment use and suitability.

INTRODUCTION

Background

The United States Department of State estimates that 80-110 million mines litter the world, the majority of which were deployed during the last 15 years. Many people are killed and wounded annually, mostly innocent civilians. Mines prevent growth and development in emerging or rebuilding countries, impede repairs to infrastructure, disrupt humanitarian aid shipments, and destroy the morale of civilians living close to the minefields.

Several efforts are underway that address the current landmine problem. The United States established the Demining Assistance Program to initiate research and development into cost-effective demining techniques. The Department of Defense Humanitarian Demining Research and Development Program at Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA is tasked with executing this program.

In one response to this tasking, commercial companies were invited to provide a capabilities demonstration of their mechanical equipment that can suitably address either one or both of the mine and/or the vegetation problems in humanitarian demining operations. The purpose of this system capabilities demonstration was to obtain information on non-developmental Mechanical Mine and/or Vegetation Clearing Systems that can demonstrate some or all of the following capabilities. 1) Support a variety of interchangeable tools capable of performing the diverse tasks involved with working in landmine suspect areas, i.e., mulchers, sifters, grinders, rakes, etc. 2) Clear a minimum of 200m²/hour of light to medium vegetation and cut 10cm diameter trees and brush. 3) Be capable of on-road and off-road operations in all types of weather and terrain. 4) Be capable of self-transport (less attachment) for distances less than 30km without destroying roads or bridges. 5) Be capable of destroying or removing landmines by grinding, sifting, raking, flailing, etc. 6) The system must be transportable, reliable, maintainable, and logistically supportable in third world mine affected countries. 7) Demonstrate the feasibility of protecting the system and operator, if applicable, with appliqué armor to withstand a blast equivalent to a .56kg (TNT) bounding fragmentation mine at 2 meters.

The Applied Research Associates (ARA), Incorporated responded by providing a capabilities demonstration of the All-Purpose Remote Transport System (ARTS.) **The information in this report is strictly based on the capabilities demonstration and not on a technical evaluation of this technology.**

System Description

ARA is a research and engineering company based in Albuquerque, NM that was established in 1979. The company initially conducted research in nuclear weapons effects and since expanded to include a wide range of technical capabilities such as the ARTS. The ARTS is a mature

system, which has been used for hazardous material handling, mine clearing operations and cleanup of unexploded ordinance. The ARTS provides a robotic platform from which to safely conduct hazardous operations by allowing the operator to be located at a safe standoff distance while conducting clearance operations through a remote control unit. The remote control provides a significant reduction in risk to the operator, but the system is currently not armored.

The ARTS consists of a prime mover (a Posi-Track™ MD70 tractor, picture 1), the Operator Control Unit (OCU, picture 2), and various tools. Tool attachments include a brush cutter (picture 1), a bucket (picture 4), pallet forks (picture 4), and a backhoe (picture 5). There are more tools available for this system such as a plow, a range clearance blade, and a water cannon, which were not demonstrated. Two cameras on top of the tractor (one camera faces forward (picture 6) and the other rearward (picture 7)) provide operational visibility when operating the vehicle remotely.

Picture 1 – ARTS with brush cutter

Picture 2 – OCU

Picture 3 – Antenna

Picture 4 – Bucket stacked on Pallet forks

Picture 5 – Backhoe

Picture 6 – Front facing Camera

Picture 7 – Rear facing Camera

The OCU is developed by ARA and provides remote operations of all tractor functions, including engine start/stop, propulsion, lights, and all tool operations. The OCU is comprised of a radio for transmitting command signals to the tractor, a receiver for audio/video signals transmitted from the tractor, a joystick control box, a television monitor with built-in videocassette recorder, an antenna (picture 3, which can be mounted on a portable tripod), and an external generator (minimum of 1kW, not included with the system). The OCU (without the antenna) is packaged in a heavy-duty, weather-tight, shock-isolated case for rugged durability. Additionally, the OCU case contains operator manuals and calibration cables.

Specifications and Dimensions

Some tractor specifications and dimensions are listed in table 1 below.

Specifications	Dimensions (English)	Dimensions (Metric)
Length	9.5ft	~2.89m
Width	5.5ft	~1.67m
Height	6.5ft	~1.98m
Weight	~6500 lbs	~2948kg
Ground Clearance	14”	~0.35m
Maximum Speed:	8mph	~12.9km/hr
Track Ground Pressure	~2psi (pounds per square inch)	0.001 ton/square inch
Line of Sight distance from OCU to vehicle	2 miles	3.2km

Table 1 – Specifications and Dimensions

Demonstration Site Description

The ARTS capabilities demonstration was conducted at NVESD/CM (countermine) test site, during September 24-26, 2001. In an effort to minimize the variety of conditions found at the test site, the vegetation and terrain have been characterized into four categories. The categories range from easy to very difficult as listed below in table 2 and shown in pictures 8-11:

Category 1 (Easy)	**Category 2** (Moderate)	**Category 3** (Difficult)	**Category 4** (Very Difficult)
Light vegetation with minimal saplings up to 3cm diameter	Moderate vegetation with sparse brush and saplings up to 6cm diameters	Moderate vegetation with brush, saplings and trees up to 10cm diameter	Heavy vegetation with dense brush, saplings and trees greater than 10cm diameter
Fairly level terrain with minimal ruts	Level to light rolling terrain with some ruts	Rolling terrain with lots of ruts	Steep hills with lots of ruts, very rugged terrain
Minimal debris and obstacles	Some debris and obstacles	Moderate debris and obstacles	Heavy debris and obstacles

Table 2 – Four categories of vegetation and terrain.

Picture 8 - Category 1

Picture 9 - Category 2

Picture 10 - Category 3

Picture 11 – Category 4

SYSTEM DEMONSTRATION

Applied Research Associates, Inc. provided documentation of and/or demonstrated capability of the ARTS in the following areas: transportation and transportability; operations and operational mobility; maintenance and maintainability; technical data; manpower and personnel; training and training equipment; and system safety. Each capability of the system presented was reviewed, documented and assessed. The system demonstration began with the arrival of the ARTS to the test site and ended with the departure of the ARTS from the test site.

Transportation and Transportability

The system was transported on a 24ft trailer that was towed by a commercial Ford F-450 heavy-duty truck to the NVESD/CM test site. The ARTS with all of its tools loaded on the trailer is shown below in picture 12. For better utilization of trailer space and limiting the number of support vehicles required, the tools were stacked upon one another, see picture 13 below. The system does not have any transportation restrictions and does not require highway permits to be transported over land.

Picture 12- ARTS with tools on trailer

Picture 13- Stacked tools

The system is transportable by truck, rail, vessel and C-130 aircraft (or larger aircrafts). The height of the system must be slightly lowered (by removing the antenna) for transport by C-130 and this should be documented in an Air Force Air Certification. If desired, and depending on the amount and type of attachments and support package, a 20-foot or a maximum 40-foot container would be sufficient for vessel transport. The system itself is highly mobile and maneuverable, even by remote control. The remote control is simple to operate, but there is a two-mile line of sight restriction with the remote control antenna. The system only has a 14-inch ground clearance, so large objects would likely impede its mobility. The system is track only, but the tracks are hard Kevlar reinforced rubber, allowing travel on macadam roads without damaging the road. Longer distances are of course limited by the remote control and power requirements, but the system is capable of being driven manually even though there is no driver seat.

Operations and Operational Mobility

ARA personnel demonstrated various aspects pertaining to the operation of the ARTS. The demonstration included; 1) the setup and tear down of the OCU, 2) the operation of ARTS with various tools 3) the changing of tools, and 4) the operational mobility of the ARTS. The system can be driven in either the reverse or forward direction depending on the mode of operation.

OCU Set-Up and Tear Down

ARA personnel demonstrated the OCU set up procedures, which took approximately 5-10 minutes with two people. The operators followed the six procedures (not outlined in the operator's manual) below in setting up the OCU. 1) Position the OCU case on a level location. 2) Open the OCU case and remove the joystick control box from the case. 3) Connect the cables from the receiver/transmitter to the joystick control box and the TV/VCR. 4) Erect the antenna and connect the antenna cable to the receiver/transmitter. 5) Ensure the external power source is on. 6) Plug the OCU power cord into the external power source and turn on the OCU power. Once the OCU is set up, communications and operational control checks (outlined in the manual) must be completed prior to operating the ARTS. The set up procedures for the OCU are easy and could be accomplished by a layman if the instructions were in the manual. For tear down of the OCU, the six procedures are reversed. ARA personnel demonstrated that tear down could be accomplished in 5 minutes with two people.

Vegetation Clearance

Category 1

Category 1 site consisted of tall grass up to 1m in height on fairly level ground, see picture 14. The ground was dry and the grass was damped from the morning dew. The site contained three large craters, one crater (.75m deep x 2.5m wide) is shown below in picture 15. The operator controlled the movements of the ARTS (with the brush cutter) through the OCU. The ARTS cut an area of 32m x 60m in 40 minutes achieving a cutting rate of 48m²/minute. The ARTS left a layer of grass clippings up to 2.5cm thick. Picture 16 below shows the ARTS cutting the grass and picture 17 shows the site after the ARTS had cut the grass. The ARTS had no difficulty cutting this vegetation or traversing this terrain even with three large craters. Visibility is limited at times, such as when the ARTS encounter the craters. The ARTS drove through the first crater because the ground depth perception is not well defined through the camera and around the other two. Normally the operator would drive the ARTS around large craters, which could potentially be obstacles for the ARTS. ARTS did not penetrate the ground in this operation. The ARTS does not have an automated float control for the brush cutter and the operator had to manually adjust the cutter height to allow the brush cutter to follow the terrain.

Picture 14 – Category 1

Picture 15 – Large crater

Picture 16 – ARTS cutting cat. 1

Picture 17 – Cat. 1 cut by ARTS

Category2

Category 2 site was a stair step terrain with thick vegetation saplings. The vegetation was predominately sumac, which was up to 6cm in diameter and 2m in height, see picture 18. The site also contained two trees, which were greater than 6cm in diameter. The ARTS was supposed to maneuver around these trees, however, due to the operator's limited visibility, the ARTS knocked down one of the two trees, see picture 19. The operator did not see the tree through the TV on the OCU until the ARTS was upon the tree. Also, the operator did not physically see the ARTS because he was located at the top of step terrain while the ARTS was at the bottom of the step terrain in the tall vegetation. The ARTS cut an area of 23m x 50m in 45 minutes, achieving a cutting rate of ~25.6m²/minutes. Picture 20 was taken from the top of the step terrain and picture 21 was taken leveled with the top of step terrain after the ARTS cut the vegetation. The ARTS left the ground covered with a layer of mulch, which ranged from 5cm to 15cm in thickness, see picture 22. During this operation, the brush cutter penetrated the ground several times (due to the unevenness of the ground) and ground penetration depth was as much as 2.5cm deep in places. The ARTS cut this type of vegetation without difficulty. At 38 minutes into this operation, the brush cutter stopped working because a fallen tree branch had disconnected the right hydraulic quick coupling. Picture 23 shows the condition of the ARTS when the cutter stop working and picture 24 shows the disconnected hydraulic coupling. Also, the tall vegetation (as seen in picture 25) obscured the operator's visibility of the ARTS. In order to continue operations, the operator had to investigate the situation and rectify the failure by reconnecting the hydraulic couplings. In an actual minefield, this quick on-the-spot repair could be a dangerous situation for the operator.

Picture 18 – Category 2 vegetation

Picture 19 – Tree knocked down by ARTS

Picture 20 – Area cut by ARTS (taken from top of step terrain)

Picture 21 – Category 2 cut by ARTS (taken level with top of step terrain)

Picture 22 – Layer of mulch

Picture 23 – Tall vegetation that obscured ARTS from operator

Picture 24 – ARTS' condition when brush cutter stopped working

Picture 25 – Disconnected hydraulic coupling

Category 3

The demonstration site consisted of dense sumac brush (up to 2m in height) and various trees on a slightly sloping terrain, see pictures 26 and 27. The variety of trees consisted of gum, maple, and oak and the majority of the trees were 10cm in diameter or less. The site contained one maple tree that was 23cm in diameter, which is considered to be a category 4 vegetation. The site was damp from the previous night's heavy rain, which made a lot of the mulch clung to the cutter rather than being blown away from the cutter. The ARTS cut an area of 36m x 28m in 60 minutes, achieving a cutting rate of 16.8m²/minute. Pictures 28 and 29 show the site after the ARTS cleared the vegetation. The ARTS left the majority of the site with a layer of mulch ranging from 2.5 to 7.5cm thick and a few spots with mulch piles ranging from 15cm to 23cm thick. Also, the ARTS left vegetation stumbles intermixed with the mulch. The 2.5cm diameter stumbles were left as tall as 30cm in height and the 5cm diameter stumbles were left as tall as 1m in height. The 23cm maple tree was cut down to 1m, see picture 30. The brush cutter, at times was underpowered because the cutter was overpowered by the amount of foliage and brush that were in the cutter. About 30 minutes into the operation, the foliage that came in contact with the ARTS depressed the emergency stop button. The stop button had to be manually pulled out in order for the ARTS to continue with operations, see picture 31. If this was an actual minefield, this situation could be a dangerous situation for the operator. The contractor recommended that mounting a cage around the stop button would prevent future accidental stops of the ARTS. The ARTS demonstrated clearing category 3 vegetation.

Picture 26 – Category 3 vegetation

Picture 27 - ARTS cutting dense sumac brush

Picture 28 – Cut category 3 vegetation

Picture 29 – Cut category 3 vegetation

Picture 30 – 23cm diameter maple trunk

Picture 31 – Resetting emergency stop button

Vegetation Clearance Summary

The ARTS performed well in clearing vegetation and navigating through terrain from category 1 (easy) through category 3 (difficult). A 23cm diameter tree was cut during category 3 operations. The brush cutter does not have floating capabilities, but with a trained operator, adjustments were made to control the cutter height to allow the cutter to follow the contour of the terrain. The operator's visibility of the ARTS was limited to only what the cameras were

pointing to. Two more cameras can be mounted to the ARTS to provide better visibility but still will not provide the operator with a complete view of the ARTS' surrounding.

Footprint Pressure Demonstration

Four trials were conducted to demonstrate the 2psi rating of the Posi-Track footprint. Theoretically, the track with 2psi should not activate any targets. Five types of antipersonnel (AP) and one type of antitank (AT) targets were used in this demonstration. Each AP target has a mechanism, which indicates activation when the appropriate amount of force has been applied to the target and the AT targets have smoke fuzes to signal activation. The targets are listed in table 3 and shown in picture 32.

Number	Target	Description	Force Required for Activation
1	AT Mine	AT mine with smoke fuze	160-340kg
2	pAP	Plastic AP blast mine	9-16kg
3	MK2	Italian AP blast mine	12kg
4	VS50	Italian AP blast mine	10kg
5	TS50	Italian AP blast mine	12.5kg
6	PMD6	Russian box mine	1-10kg

Table 3 – Demonstration Targets

Picture 32 - Demonstration targets

Trial One

A lane (25m by 3m) with surface laid AP mines was set up for this trial, see picture 33. The AP mines were an MK2, a VS50, a TS50, a pAP and a PMD6. The operator manually drove the ARTS through the lane, ensuring that the track ran over the mines as the ARTS traversed the lane, see picture 34. Each target was activated. Picture 35 shows a crushed PMD6. The result demonstrated that the track applied sufficient force to activate all targets, which indicates that the track pressure output is greater than 2psi on an uneven surface (the mines were above the ground).

Picture 33 – Surface laid AP mine lane

Picture 34 – ARTS traversing AP mine lane

Picture 35 - Crushed PMD6

Trial Two

For trial two, a 25m by 3m lane was set up with five AP mines (1-PMD6, 1-MK2, 1-VS50, 1-TS50 and 1-pAP) buried flush. The ARTS activated the VS50, the pAP, and the PMD6 mines. The results demonstrated that sometimes, the track pressure was greater than the 2psi rating when the ARTS encountered unleveled ground. Also, the number of mines functioned by the ARTS was 60% as compared to the first trial of 100%.

Trial Three

Three AT mines with smoke fuzes were surface laid in a 25m by 3m lane, see picture 36. The operator manually drove the ARTS over the mines, see picture 37. The track activated all three smoke fuzes. The result demonstrated that the track applied sufficient force to activate the surface laid AT mines.

Picture 36 – Surface laid AT mine lane

Picture 37 – ARTS activating a smoke fuze

Trial Four

Three AT mines with smoke fuzes were buried flush to the ground. The operator manually drove the ARTS system over the flush laid mines with the rubber track. Only one mine was activated when the ARTS teetered back on the mine while the track encountered a mound on the ground, picture 38 shows the functioned AT mine. Picture 39 shows a non-activated AT mine that was run over with the track.

Picture 38 – Activated AT mine

Picture 39 – AT mine not activated

Footprint Pressure Summary

On a level surface, the track would normally exert only 2psi. However, if there are ruts or bumps in the ground and the tractor is resting on them, then the highest point on the ground would be carrying most of the tractor's weight, therefore exerting greater than the rated 2psi of pressure at that point. The possibility for the ARTS to activate mines is less when the mines are buried in the ground as compared to when the mines are above the ground.

Excavation

ARA personnel demonstrated the backhoe operation by excavating some dirt. Pictures 40-42 show the backhoe in operation. The excavator can dig as deep as 2.5m deep. The excavation was operated remotely through the OCU. ARA personnel gave each Humanitarian Demining team member an opportunity and instructions on how to operate the backhoe. Every member was successful in learning how to operate the backhoe within 5-15 minutes. However, to become a proficient operator would require additional 8-20 hours of hands-on time, dependent on the trainee's ability.

Picture 40 – Backhoe digging up dirt

Picture 41 – Backhoe moving dirt

Picture 42 – Backhoe dumping dirt

Changing Tools

ARTS is a versatile system because it can operate a variety of tools and each tool has a specific purposes. ARA personnel demonstrated how to change each tool. Changing tools was conducted with an operator in the vehicle and an assistant on the ground guiding the operator to the tool. Table 4, below depicts the amount of time ARA personnel took to change each tool. Pictures 43-45 show the sequence of events while attaching the brush cutter. ARA personnel (highly skilled operators) made changing tools looked easy. More time would probably be required for a layman who had just started operating the system.

Tool	Purpose	Demonstrated Time (minutes)
Brush Cutter	Cut vegetation	1.50
Pallet Forkes	Lift and Move heavy/large objects	1.83
Bucket	Move the earth	3.25
Backhoe	Excavate the ground	6.00

Table 4 – Changing Tools

Picture 43 –Aligning ARTS to tool

Picture 44 – Attaching brush cutter

Picture 45 – Brush cutter attached

Operational Mobility

A 2km course was set up to evaluate the mobility of the ARTS, see the diagram below. The course consisted of rugged dirt trail and gravel road with some hills (30-40 degree inclines), lots of ruts (30-60cm deep), and over hanging branches. Two mobility and one obstacle breaching trials were conducted during the mobility demonstration. For the first mobility trial, an ARA technician operated the ARTS manually and completed the 2km course in 10 minutes. The ARTS was manually operated because the operator thought that the trees and the terrain would impede the line of sight of the radio and video transmissions. The second trial was conducted by one of the HD engineers using the OCU to see if any interference would occur. The second trial was successful and without any interrupted signal between the OCU and the vehicle. When the vehicle was at the farthest point (1km away and at the bottom of the hill) from the OCU, the video was a little snowy but no transmission was loss. The OCU and the vehicle operated without any problems.

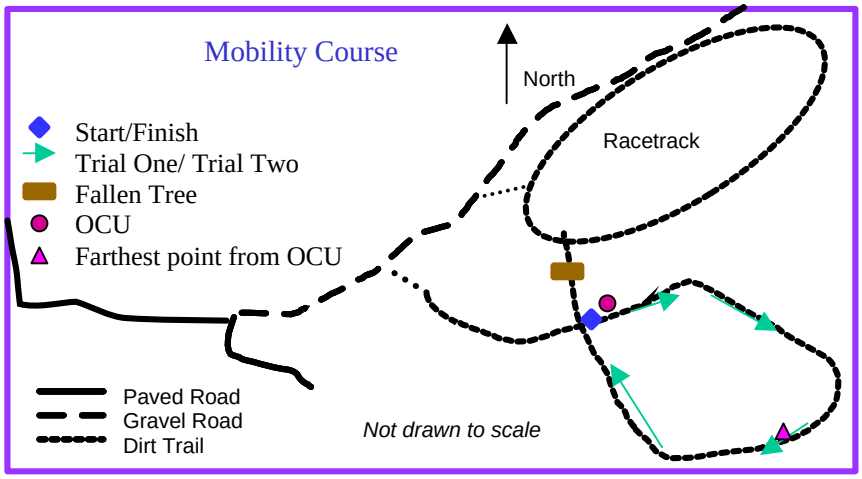

Diagram - Mobility Course

Picture 46 – Bucket moving debris

Picture 47 – Passage cleared of obstacle

A tree, approximately 50cm in diameter, was used as the obstacle in the breaching operation. The tree had fallen across the dirt trail (see diagram, above) and started to dry rot. The ARTS with the bucket was operated manually and completed the breaching operation in 5 minutes. The operator used the weight of the ARTS and the hardness of the bucket to tear the tree up and then used the bucket to move and push the tree trunk around until the tree was no longer an obstacle. Picture 46 shows the bucket moving the dirt to the side of the trail and picture 47 shows the passage cleared of the obstacle.

Maintenance and Maintainability

The prime mover is made by All Season Vehicle, Inc., an American company that has joined with Caterpillar Corp., so it should be supportable worldwide. Applied Research Associates (ARA), the original manufacturer of the remote control and the modifications of the vehicle, support the OCU and the system robotics by providing repair parts (mainly fuses and actuators) with the support package. ARA also will set up field support, repair and return or one for one replacement agreements, depending on the wishes of the customer. Daily checks and other preventive maintenance check and services (PMCS) and repair actions are well documented by written and picture references. A track replacement, in the field, should only take about one hour with a minimum of two people. An initial support package can be developed and purchased easily and would include system calibration software/firmware. However, a laptop computer would be separately required to complete calibration procedures.

ARTS Calibration

The contractors demonstrated the calibration of the actuators on the ARTS. Calibration allows the limits of travel for each actuator to be set. Detailed calibration procedures are outlined in the operator's manual and should be completed by a trained operator. Calibration of the system is not a routine maintenance item and should only be required when operating the ARTS for the first time or when an actuator is replaced.

Changing Track

Two members of the Humanitarian Demining team changed the left track with instructions from the ARTS technician. The amount of time taken to change the track was approximately one hour. The tools that were used to change the track are shown in picture 48 below. The procedures for track removal and installation are documented in the Posi-Track Operator and Service Manual. Pictures 49-53 show different stages of the track changing process. Changing track is not a difficult task but a time consuming and labor intensive one and should only be completed by a trained operator or with the assistant of a trained operator.

Picture 48 – Track changing tools

Picture 49 – Removing track locking bolts

Picture 50 – ARTS on jack stand

Picture 51 – Adjusting track length

Picture 52 – Releasing rear axle tension

Picture 53 – Track removed

Technical Data

Detailed technical documentation is provided up front during training and includes an ARA Operator and Maintenance Technical Manual (U.S. Air Force verified) and Commercial Off the Shelf (COTS) manuals for the vehicle, Isuzu engine and other items like tool attachments. Parts lists with line drawing breakouts are also provided.

The ARTS' Operator and Maintenance Technical Manual is very detailed, but it does not contain instructions on how to set up the OCU or when to conduct calibrations. ARA stated that this information could be added to the manual.

Manpower and Personnel

Two people can operate and maintain the ARTS. One person is needed as the main operator and another is needed as an assistant to help with maintenance and operations.

Training and Training Equipment

Training has previously been provided to U.S. Air Force personnel. ARA recommended that at least two operators/maintainers be trained for each ARTS. To be truly effective, a classroom with computers for the students should be made available for use of the compact disc training materials. The remainder of the training can and should take place in a field environment. A minimum of three days is required for operator/maintenance training, but additional time would probably be required for foreign national personnel, especially if interpreters are required. The system is very easy to operate, especially the remote control. Learning the controls on the control box and becoming proficient with the controls should not take an inordinate period of time.

System Safety

Neither a blast nor a survivability test was conducted on the ARTS only an engineering assessment of the system safety features was conducted. The system is currently not armored, but the system is remotely controlled. Any and all hazardous environment operations could be accomplished with the operator at a distance of up to 3.2km away or at the line of sight limit of the video relay. This remote capability provides added safety to the operator. The system if armored, would probably withstand antipersonnel blast mine explosions while possibly incurring minor damages. Fragmentation mine explosions would be more damaging to the ARTS and the antitank mine explosions would inflict greater damages.

ARTS SUMMARY

The ARTS proved to be a very robust and user-friendly system that offers a modular clearance and neutralization toolkit capability to conduct a variety of tasks. These tasks/capabilities include: vegetation clearance, excavation, mine clearance, and others. The heart of this system is the OCU, which allows the operator to remotely conduct hazardous operations from a safe standoff distance.

The OCU proved to be easy to operate. The OCU controlled all attachments and most of the tractor functions. The ARTS is an easy system to learn to operate, but will required some hands-on-time to become proficient. The amount of time needed is dependent on the trainee's ability.

The ARTS demonstrated the capability of clearing category 1 to 3 vegetation and also clearing a 23cm diameter maple tree, which is considered to be a category 4 vegetation. The ARTS demonstrated a clearance rate of approximately 1530m²/hour of the category 2 vegetation.

Although neither survivability nor blast test was conducted on the ARTS, the system provides adequate protection to the operator by being remotely controlled and the operator could be as far away as 3.2km from the ARTS. Visibility for the operator is limited to whatever the camera is viewing. Depth perception is not well defined on the TV monitor.

The ARTS can traverse most terrain with slopes less than 40 degrees. The ARTS can travel over paved roads without damaging the roads with its rubber tracks and can achieve speeds up to 8km/hr.

The ARTS performed well and was problem-free during this demonstration period.